San Joaquin Valley Aerosol Health Effects:
Particulate Matter Sources, Characteristics and Effects on Health and Lung Development

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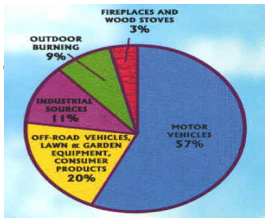
Where is the San Joaquin Valley?

How bad is it anyway?

Where does the air pollution come from?



WHAT'S THE PROBLEM? Health Effects of Air Pollution

Take a deep breath. Now entering your lungs, bloodstream, and perhaps your brain, is "air" bearing all the exhalations of modern life: tailpipe exhaust, fireplace smoke, flame-broiled animal fats, industrial chemicals, and carpet fumes. If you are within 100 yards of a freeway, you also have inhaled tire shreds and partially burned diesel fuel. If downwind from a farm, then you have inhaled ammonia from animal wastes or soot from burning rice straw. At the coast, you'll breathe in salt, of course, maybe trans-Pacific sand from eroding Chinese deserts, and perhaps something unexpected: sulfuric acid from the smokestacks of unregulated cargo and cruise ships.

University of California (UC) Davis researchers have found disturbing patterns linking air pollution with serious human health problems in susceptible populations, including chronic asthma in children and early death in some adults. PM can accumulate deep in your airways contributing to decreased lung function and can impair lung growth in children. Ozone may exacerbate these problems.

UC Davis are investigating the links between Particulate Matter (PM) in the ambient air of the San Joaquin Valley of California (SJV) and health effects on children and adults. The SJV air basin has the highest population growth rate in California. From 1990 to 2000, the population grew by almost 20 percent and daily vehicle miles traveled increased more than 25 percent. EPA has designated the SJV as the third worst PM-10 nonattainment area in the U.S. behind Los Angeles and Phoenix. The SJV has a high asthma rate among children aged 0-17 (11-16%) when compared to the San Francisco Bay, the Los Angeles Region and the state of California. The EPA STAR program is funding this five year study that began in 2005 and continues through 2010.

WHAT RESEARCH HAS BEEN DONE BEFORE?

Regulated*: PM10 and PM2.5 in the National Ambient Air Quality Standards* ***Unregulated****: Ultrafine Particulate Matter*

Sizes of these particles: PM10 are those less then 1/10 of a human hair; PM2.5 less than 1/40; Ultrafine PM less than 1/1000

- Effects on heart patients: Heart attacks increase
- Effects on our children: Breathing capacity decreases and may last into adulthood
- Effects on other organs: Ultrafine particles move from the lungs to other tissues, such as heart and brain
- Increased deaths: Worldwide studies show particles increase death rates

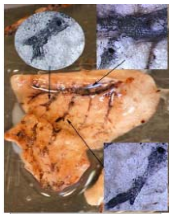
WHAT ARE WE GOING TO STUDY?

Particles responsible for human health effects, the metabolism that underlies these effects, and the consequences of chronic exposures particularly during childhood.

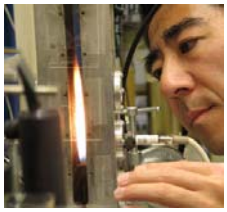
1. **Pulmonary response**
   - *Is increased neonatal vulnerability exacerbated when PAHs are adsorbed to environmental and synthetic particulate matter in postnatal and adult rat lungs?*
2. **Cardiovascular response**
   - *What are the effects of ultrafine particulates on endothelial and vascular inflammatory responses? What is the potential association between atherosclerotic vascular disease and circulating PM?*
3. **Whole animal effects metabolic effects**
   - *How does variation in particle concentration, size and/or composition affect heart rate variability and oxidative stress in mice exposed to concentrated airborne particles at urban and rural locations in SJV during the summer and winter?*
4. **Transport of particles from airways to other tissues**
   - *What are the effects of size and charge on the time course, distribution and mechanisms of accumulation of PM in circulation and tissues of animals with normal and altered lung structure*
5. **Effects of particles and gases on lung development in juveniles**
   - *What is the amount and time course of pollutants that lead to lung architectural abnormalities and their functional implications?*

HOW DO WE DO IT?

Animal Exposures

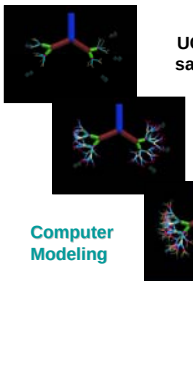


Exposed Lungs



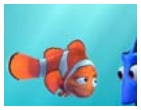
Combustion Particles

MicroMRI Imaging



Computer Modeling

UC Davis researchers use the same computer techniques as PIXAR to model lung development in children



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